Sol. $Cu^{2+} + 4NH_3 \rightleftharpoons [Cu(NH_3)_4]^{2+}$ $\quad k_f$

$k_f = k_1 \times k_2 \times k_3 \times k_4$

$k_f = 10^4 \times 2 \times 10^3 \times 5 \times 10^2 \times 100 = 10^{12}$

so, dissociation constant for $[Cu(NH_3)_4]^{2+}$ is $k_d = \dfrac{1}{k_f} = 1 \times 10^{-12}$

So, x = 1

30. When 9.45 gram of $ClCH_2COOH$ is dissolve in water and resulting solution is made 500 ml, then depression in freezing point is 0.5°C. Then percentage dissociation of $ClCH_2COOH$ is :

[Given $K_F(H_2O) = 1.86 \dfrac{k.kg}{mole}$]

Ans. **07.50**

Sol. $ClCH_2COOH \longrightarrow ClCH_2COO^- + H^+$ $\quad [n = 2]$

$i = 1 + (n - 1)\alpha = (1 - \alpha)$

$\Delta T_F = i\,[K_F \times m]$

$0.5 = i\left[1.86 \times \dfrac{9.45 \times 1000}{94.5 \times 500}\right]$

$i = 1.075$

$\alpha = 7.5\ \%$

28. For a chemical reaction at 300 K temperature and 1 atm pressure value of equilibrium constant is 100 and value of $\Delta G^\circ_{rxn.}$ is "–xR", then value of 'x' is :
(Given, R = 8.314 J/mol×K, ln10 = 2.3)

Ans. (1380)

Sol. For chemical reaction at equilibrium

$\Delta G^\circ = -RT \ln K_{eq}$

$\Delta G^\circ = -R \times 300 \times \ln 100$

$\Delta G^\circ = -R \times 300 \times \ln (10)^2$

$\Delta G^\circ = -R \times 300 \times 2 \times 2.3$

$\Delta G^\circ = -1380\ R$

So, $x = 1380$

29. (i) $Cu^{2+} + NH_3 \rightleftharpoons [Cu(NH_3)]^{2+}$ $k_1 = 10^4$

(ii) $[Cu(NH_3)]^{2+} + NH_3 \rightleftharpoons [Cu(NH_3)_2]^{2+}$ $k_2 = 2 \times 10^3$

(iii) $[Cu(NH_3)_2]^{2+} + NH_3 \rightleftharpoons [Cu(NH_3)_3]^{2+}$ $k_3 = 5 \times 10^2$

(iv) $[Cu(NH_3)_3]^{2+} + NH_3 \rightleftharpoons [Cu(NH_3)_4]^{2+}$ $k_4 = 100$

dissociation constant of $[Cu(NH_3)_4]^{2+}$ is $x \times 10^{-12}$, then value of 'x' is

Ans. (1)

26. Proton and Li^{3+} ion are accelerated with same potential difference then ratio of de-broglie wave length (λ) is …….. . [Given mass of Li^{3+} is 8.33 times mass of proton]

Ans. (5)

Sol. $\lambda = \dfrac{h}{\sqrt{2m\,(qV)}}$

$$\frac{\lambda_{H^+}}{\lambda_{Li^{3+}}} = \sqrt{\frac{m_{Li^{3+}}[3]}{m_{H^+}[1]}} = \sqrt{\frac{8.33\times 3}{1}} = 5$$

27. Conversion of cyclobutene to butadiene follows 1 st order kinetic, then how much time is taken in 40% completion of reaction [in minute]. If rate constant $k = 3.33 \times 10^{-5}$ sec.

Ans. (255.45)

Sol. $t_{x\%} = \dfrac{2.303}{K} \log \dfrac{100}{100-x}$

$$= \frac{2.303}{3.33\times 10^{-5}} \log \frac{100}{100-40}$$

$$= \frac{3\times 2.303\times 10^{4}}{1} \log \frac{100}{60}$$

$$= \frac{3\times 2.303\times 10^{4}}{1} \log \frac{5}{3}$$

= 15327.53 sec. = 255.45 minute.

Sol. $\text{molarity} = \frac{W}{M \times V_{ml}} \times 1000$

$= \frac{4.5}{90 \times 250} \times 1000$

$= \frac{1}{5} = 0.2$

$= 2 \times 10^{-1}$ Ans. $x = 2$

24. For equilibrium reaction at 1900 K temperature & 1 atm pressure

$Cl_2(g) \rightleftharpoons 2Cl(g)$

at equilibrium both Cl_2 & Cl have equal number of moles, if the value of K_p is $x \times 10^{-1}$ then value of x is :

Ans. (5)

Sol. $Cl_2(g) \rightleftharpoons 2Cl(g)$

½atm ½atm

$$K_p = \frac{(1/2)^2}{(1/2)}$$

$$K_p = \frac{1}{2} = 0.5$$

$$K_p = 5 \times 10^{-1}$$

25. 4.5 gram of a compound 'A' of molecular mass 90 is dissolve in water and made 250 ml solution then molarity of solution is $[x] \times 10^{-1}$ then value of 'x' is

Ans. (2)

22. Find the total number of amphoteric compound from following
BeO, $Be(OH)_2$, BaO, $Sr(OH)_2$

Ans. (2)

Sol. BeO, $Be(OH)_2$ are amphoteric.

23. $S_8 + \mathbf{a}\ OH^- \longrightarrow \mathbf{b}\ S^{2-} + \mathbf{c}\ S_2O_3^{2-} + \mathbf{d}\ H_2O$
In balanced equation what is the value of **(a)**.

Ans. (12)

Sol. $S_8 + \mathbf{a}\ OH^- \longrightarrow \mathbf{b}\ S^{2-} + \mathbf{c}\ S_2O_3^{2-} + \mathbf{d}\ H_2O$

(1) **Reduction Half reaction :**

$16e^- + S_8 \longrightarrow 8S^{2-}$

(2) **Oxidation Half reaction :**

$24OH^- + S_8 \longrightarrow 4S_2O_3^{2-} + 12H_2O + 16e^-$

On adding (1) & (2)

Net redox reaction is

$2S_8 + 24OH^- \longrightarrow 8S^{2-} + 4S_2O_3^{2-} + 12H_2O$

$S_8 + 12OH^- \longrightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

Ans. a = 12

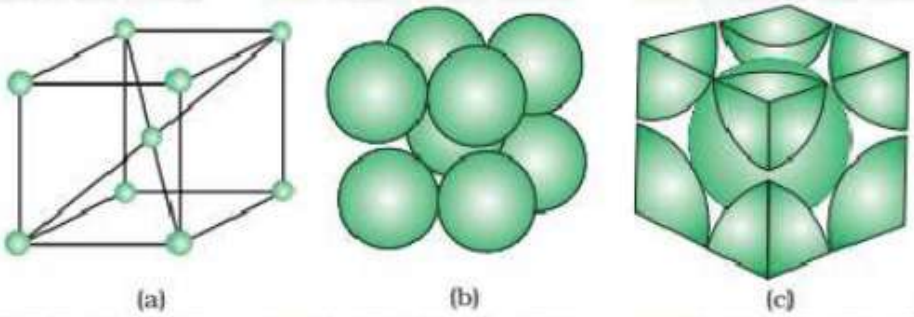
Numerical Value Type

This section contains **10 Numerical value type questions.**

21. In BCC [Body centred cubic] crystal structure co-ordination number is:

Ans. (8)

Sol. A body-centred cubic (bcc) unit cell has an atom at each of its corners and also one atom at its body centre. Fig. depicts (a) open structure (b) space filling model and (c) the unit cell with portions of atoms actually belonging to it. It can be seen that the atom at the filling structure (c) actual portions of atoms belonging to one unit cell.



19. Identify the iso-structural pair from following

(a) $SiCl_4$, $TiCl_4$ (b) NH_3, NO_3^- (c) NH_3, ClO_3^- (d) CO_2, SO_2

(1) a, b (2) b, c (3) b, d (4) a, c

Ans. (4)

Sol.

$SiCl_4$	$\rightarrow$	sp^3 hybridisation	$\rightarrow$	Tetrahedral
$TiCl_4$	$\rightarrow$	sp^3 hybridisation	$\rightarrow$	Tetrahedral
$\ddot{N}H_3$	$\rightarrow$	sp^3 hybridisation ($\ell p = 1$)	$\rightarrow$	Pyramidal
NO_3^-	$\rightarrow$	sp^2 hybridisation ($\ell p = 0$)	$\rightarrow$	Trigonal planar
CO_2	$\rightarrow$	sp hybridisation	$\rightarrow$	Linear
SO_2	$\rightarrow$	sp^2 hybridisation ($\ell p = 1$)	$\rightarrow$	V-shape

20. Which of the following ore is extracted with the help of cyanide salt.

(1) sphalerite (2) siderite (3) malachite (4) calamine

Ans. (1)

Sol. NaCN reacts with ZnS and forms a layer of $Na_2[Zn(CN)_4]$ complex on the surface of ZnS and thus prevents it from the formation of froth.

$ZnS + CN^- \longrightarrow [Zn(CN)_4]^{2-}$

Sol. $Na_2B_4O_7.10H_2O \longrightarrow Na_2B_4O_7 \longrightarrow 2NaBO_2 + B_2O_3$

Oxidising flame [Non-luminous flame]

$CuSO_4 \longrightarrow CuO + SO_3$

$CuO + B_2O_3 \longrightarrow \overset{+2}{Cu}(BO_2)_2$

Blue bead

Reducing flame [luminous flame]

$Cu(BO_2)_2 + C \longrightarrow 2\overset{+1}{Cu}BO_2 + CO + B_2O_3$

$2CuBO_2 + C \longrightarrow 2\overset{0}{Cu}(s) + B_2O_3 + CO(g)$

18. **Statement-I :** In borax bead test, copper salts give cupric metaborate in non Luminous flame.
Statement-II : In borax bead test, copper salts give cuprous metaborate in Luminous flame.
(1) Both Statement-I & II are correct.
(2) Both Statement-I & II are incorrect.
(3) Statement-I is correct & Statement-II is incorrect.
(4) Statement-I is incorrect & Statement-II is correct.

Ans. (1)

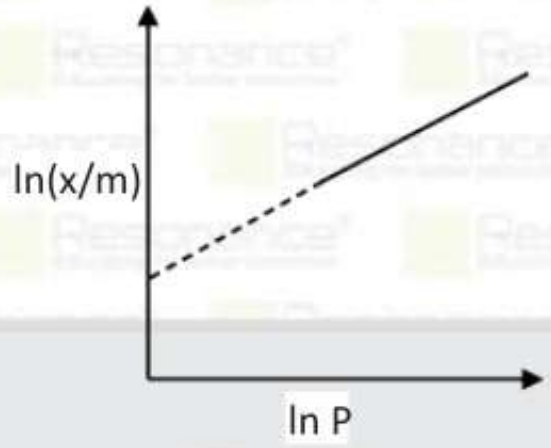
$\because \frac{x}{m} \propto P$ at low pressure region

$\therefore \frac{1}{n} = 1 \Rightarrow n = 1$

$\therefore \frac{x}{m} \propto P^{o}$ [constant] at high pressure region

Pressure	Graph	Relation
At low pressure	straight line	$\frac{x}{m} = kP$
At intermediate pressure	dependent on power of pressure	$(x/m) = kp^{1/n}$ $(0<\frac{1}{n}<1)$
At high pressure	Independent of pressure	$\frac{x}{m} = k$

17. For given Freundlich isotherm graph



Slope is

(1) $\frac{1}{n}$ [with n between 0 to 1]

(2) $\frac{1}{n}$ [with n between 0.5 to 0.1]

(3) $\frac{1}{n}$ [with n > 1]

(4) n[with n < 1]

Ans. (3)

Sol. $\frac{x}{m} = kP^{1/n}$

$\ln\frac{x}{m} = \ln K + \frac{1}{n}\ln P$

Slope = $\frac{1}{n}$

14. **Case-I :** $I_2 + H_2O_2 \rightarrow O_2 + 2I^- + 2H^+$

Case-II : $2H^+ + H_2O_2 + 2OCl^- \rightarrow Cl_2 + O_2 + 2H_2O$

(1) In Case-I H_2O_2 act as oxidising agent and in Case-II H_2O_2 act as reducing agent.

(2) In both Case H_2O_2 act as reducing agent.

(3) In both Case H_2O_2 act as oxidising agent.

(4) In Case-I H_2O_2 act as reducing agent and in Case-II H_2O_2 act as oxidising agent.

Ans. (2)

Sol. In both Case H_2O_2 act as reducing agent.

15. For which of the following metal $M^{2+}(aq) + 2e^- \longrightarrow M(s)$ reaction have positive reduction potential value.

(1) Fe (2) Cu (3) Zn (4) Al

Ans. (2)

Sol. Copper is placed below the Hydrogen in electrochemical series.

16. $Al_2O_3.xH_2O \xrightarrow{NaOH}$ 'A' $\xrightarrow{B(gas)}$ 'C'

Impure

Then A, B, C are respectively.

(1) $Na[Al(OH)_4]$, CO_2, Al_2O_3

(2) $Al(OH)_3$, CO_2, $Al_2O_3.xH_2O$

(3) $Al(OH)_3$, SO_2, $Al_2O_3.xH_2O$

(4) $Na[Al(OH)_4]$, HCl, Al_2O_3

Ans. (1)

Sol. $Al_2O_3.xH_2O \xrightarrow{NaOH} Na[Al(OH)_4] \xrightarrow[\text{Acidic oxide}]{CO_2(gas)} Al(OH)_3 \xrightarrow{heat} Al_2O_3$

Amphoteric Nature [Soluble in NaOH]

Soluble Complex

Reprecipitated

12. Correct order of 1st ionisation potential of Mg, Al, Si, P, S is

(1) Al < Mg < Si < S < P (2) Mg < Al < Si < S < P

(3) Mg < Al < Si < P < S (4) Al < Mg < Si < P < S

Ans. (1)

Sol. $Mg_{12} = 1s^2 2s^2 2p^6 3s^2$

$Al_{13} = 1s^2 2s^2 2p^6 3s^2 3p^1$

$Si_{14} = 1s^2 2s^2 2p^6 3s^2 3p^2$

$P_{15} = 1s^2 2s^2 2p^6 3s^2 3p^3$

$S_{16} = 1s^2 2s^2 2p^6 3s^2 3p^4$

13. Composition of Gun Metal is :

(1) (Cu + Zn + Sn) (2) (Cu + Zn + Ni) (3) (Cu + Sn) (4) (Cu + Zn)

Ans. (1)

Sol. (1) (Cu + Zn + Sn) (87 : 3 : 10) Gun metal

(2) (Cu + Zn + Ni) (2 : 1 : 1) German Silver

(3) (Cu + Sn) (80 : 20) Bell Metal

(4) (Cu + Zn) (60-80 : 40-20) Brass

12. Correct order of 1st ionisation potential of Mg, Al, Si, P, S is

(1) Al < Mg < Si < S < P (2) Mg < Al < Si < S < P

(3) Mg < Al < Si < P < S (4) Al < Mg < Si < P < S

Ans. (1)

Sol. $Mg_{12} = 1s^2 2s^2 2p^6 3s^2$

$Al_{13} = 1s^2 2s^2 2p^6 3s^2 3p^1$

$Si_{14} = 1s^2 2s^2 2p^6 3s^2 3p^2$

$P_{15} = 1s^2 2s^2 2p^6 3s^2 3p^3$

$S_{16} = 1s^2 2s^2 2p^6 3s^2 3p^4$

13. Composition of Gun Metal is :

(1) (Cu + Zn + Sn) (2) (Cu + Zn + Ni) (3) (Cu + Sn) (4) (Cu + Zn)

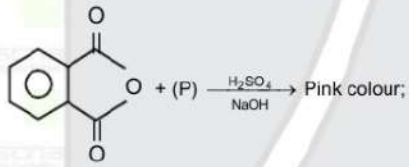
Ans. (1)

Sol. (1) (Cu + Zn + Sn) (87 : 3 : 10) Gun metal

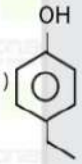
(2) (Cu + Zn + Ni) (2 : 1 : 1) German Silver

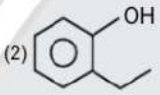
(3) (Cu + Sn) (80 : 20) Bell Metal

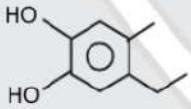
(4) (Cu + Zn) (60-80 : 40-20) Brass

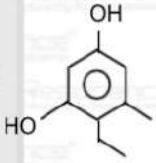
11.  + (P) $\xrightarrow[NaOH]{H_2SO_4}$ Pink colour;

Missing reagent 'P' is :

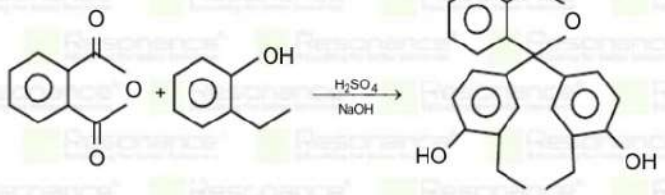
(1) 

(2) 

(3) 

(4) 

Ans. **(2)**

Sol. 

Pink colour
(derivative of phenolphthalein)

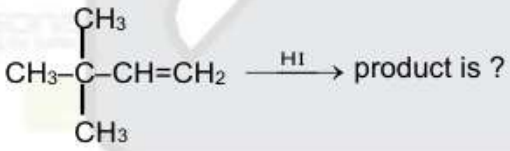
8. The gas which is released during anaerobic vegetative degradation causes ?

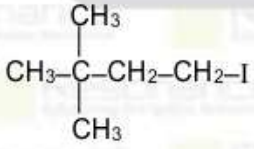
(1) O_3 deplition (2) Cancer + global warming

(3) Acid rain (4) Corrosion of metals

Ans. (2)

Sol. Due to excess release of CH_4 gas during anaerobic vegetative degradation which causes global warming & Cancer.

9. 

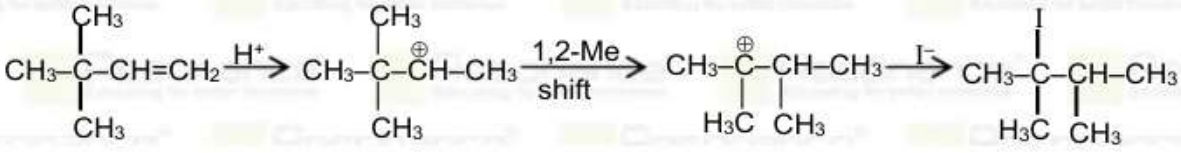
(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. 

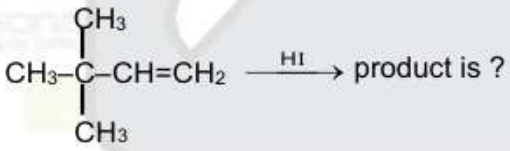
8. The gas which is released during anaerobic vegetative degradation causes ?

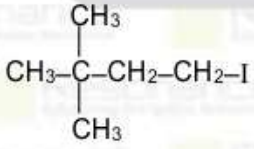
(1) O_3 deplition (2) Cancer + global warming

(3) Acid rain (4) Corrosion of metals

Ans. (2)

Sol. Due to excess release of CH_4 gas during anaerobic vegetative degradation which causes global warming & Cancer.

9. 

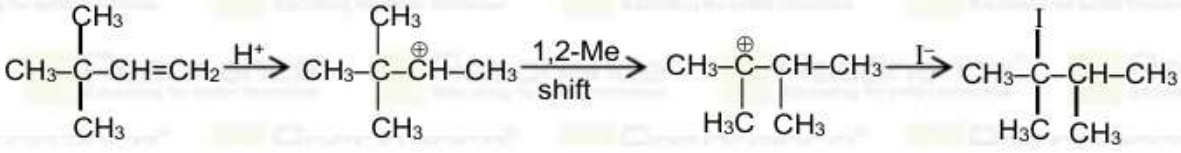
(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. 

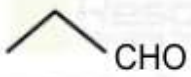
6. $CH_3–CH_2–CH_3 \xrightarrow{\text{Reagent}} CH_3–CH_2–CHO$

Reagent is :

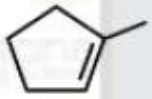
(1) Mo_2O_3 (2) Manganese acetate

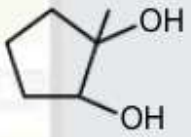
(3) $KMnO_4$ (4) Cu

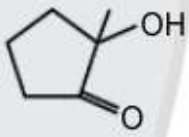
Ans. (1)

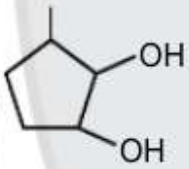
Sol. $CH_3–CH_2–CH_3 \xrightarrow{Mo_2O_3}$ 

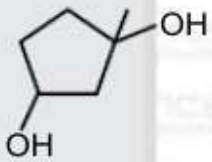
Controlled oxidation

7.  $\xrightarrow[H_2O]{KMnO_4/OH^-}$ A $\xrightarrow[H^+]{CrO_3}$ B Product is ?

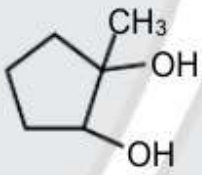
(1) 

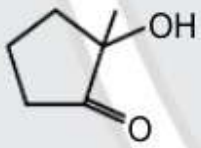
(2) 

(3) 

(4) 

Ans. (2)

Sol.  $\xrightarrow[H_2O]{KMnO_4/OH^-}$ 

$\xrightarrow[H^+]{CrO_3}$ 

Syn hydroxylation